



## General

### Guideline Title

ACR Appropriateness Criteria® right upper quadrant pain.

### Bibliographic Source(s)

Yarnish GM, Smith MP, Rosen MP, Baker ME, Blake MA, Cash BD, Hindman NM, Kamel IR, Kaur H, Nelson RC, Piorkowski RJ, Qayyum A, Tulchinsky M, Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® right upper quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 9 p. [44 references]

### Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Katz DS, Rosen MP, Blake MA, Baker ME, Cash BD, Fidler JL, Grant TH, Greene FL, Lalani T, Miller FH, Small WC, Sudakoff GS, Warshauer DM, Yee J, Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® right upper quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2010. 5 p.

## Recommendations

### Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Right Upper Quadrant Pain

Variant 1: Fever, elevated WBC, positive Murphy sign.

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	9		O
MRI abdomen without and with contrast	6	See statement regarding contrast in text below under "Anticipated Exceptions."	O
Cholescintigraphy	6	Based on US findings, this generally should follow US of the right upper quadrant.	<input type="text"/> <input type="text"/>
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation

Radiologic Procedure	Rating	Comments	RRL*
MRI abdomen without contrast	4		O
CT abdomen without contrast	4		<input type="text"/> <input type="text"/> <input type="text"/>
CT abdomen without and with contrast	3		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Suspected acalculous cholecystitis.

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	8	If gallbladder dilation, wall thickening, or fluid are present, proceed with percutaneous cholecystostomy, as clinically indicated.	O
MRI abdomen without and with contrast	6	See statement regarding contrast in text below under "Anticipated Exceptions."	O
Cholescintigraphy	6	This procedure is used for hospitalized patients, following an equivocal US.	<input type="text"/> <input type="text"/>
CT abdomen with contrast	6		<input type="text"/> <input type="text"/> <input type="text"/>
Percutaneous cholecystostomy	6	This can be both diagnostic and therapeutic, particularly with ICU patients. Consider using this procedure for the nonoperative patient or if other causes of sepsis have been excluded. This usually requires imaging first. It is performed only in certain patients (elderly, immunocompromised, etc.).	Varies
MRI abdomen without contrast	4		O
CT abdomen without contrast	4		<input type="text"/> <input type="text"/> <input type="text"/>
CT abdomen without and with contrast	3		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: No fever, normal WBC.

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	9	This is performed to exclude a diagnosis of stones and bile duct obstruction.	O
MRI abdomen without and with contrast	6	See statement regarding contrast in text below under "Anticipated Exceptions."	O
Cholescintigraphy	6	This is performed if US is equivocal.	<input type="text"/> <input type="text"/>
CT abdomen with contrast	6		<input type="text"/> <input type="text"/> <input type="text"/>
MRI abdomen without contrast	5		O
CT abdomen without contrast	3		<input type="text"/> <input type="text"/> <input type="text"/>
CT abdomen without and with contrast	3		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: No fever, normal WBC, ultrasound shows only gallstones.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen with contrast	7		<input type="text"/> <input type="text"/> <input type="text"/>
MRI abdomen without contrast	6		O
MRI abdomen without and with contrast	6	See statement regarding contrast in text below under "Anticipated Exceptions."	O
Cholescintigraphy	6	This is performed to exclude other sources of pain from the diagnosis.	<input type="text"/> <input type="text"/>
CT abdomen without contrast	3		<input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Radiologic Procedure	Rating	Comments	RRL*
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Hospitalized patient with fever, elevated WBC, and positive Murphy sign.

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	9		O
CT abdomen with contrast	7		<input type="text"/> <input type="text"/> <input type="text"/>
MRI abdomen without and with contrast	6	See statement regarding contrast in text below under "Anticipated Exceptions."	O
Cholescintigraphy	6	This is performed if US is inconclusive.	<input type="text"/> <input type="text"/>
Percutaneous cholecystostomy	6	This can be both diagnostic and therapeutic, particularly with ICU patients. Consider using this for the nonoperative patient or if other causes of sepsis have been excluded. This usually requires imaging first. It is performed only in certain patients (elderly, immunocompromised, etc.).	Varies
MRI abdomen without contrast	5		O
CT abdomen without contrast	4		<input type="text"/> <input type="text"/> <input type="text"/>
CT abdomen without and with contrast	3		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Fever, leukocytosis, pregnant patient.

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	9		O
MRI abdomen without contrast	8		O
MRI abdomen without and with contrast	3	See statement regarding contrast in text below under "Anticipated Exceptions."	O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative

Cholescintigraphy Radiologic Procedure	Rating	Comments	RRL*
CT abdomen without contrast	3		<input type="text"/> <input type="text"/> <input type="text"/>
CT abdomen with contrast	3		<input type="text"/> <input type="text"/> <input type="text"/>
CT abdomen without and with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

## Summary of Literature Review

### Introduction/Background

Acute right upper quadrant pain is very common as a presenting symptom in hospital emergency departments and occasionally in patients hospitalized initially for unrelated conditions. This review will focus largely on the diagnostic accuracy of imaging studies performed to evaluate acute cholecystitis (AC), the primary diagnostic concern in the setting of acute right upper quadrant pain.

AC may be life-threatening; therefore, correct, timely diagnosis is essential for proper treatment. However, information derived only from clinical history, physical examination, and routine laboratory tests has not yielded acceptable likelihood ratios sufficient to predict the presence or absence of AC. Also, this information does not yield sufficient diagnostic certainty for making management decisions. Imaging studies, therefore, play a major role in establishing a diagnosis of AC and assessing possible alternate diagnoses, if AC is not present.

Radiography of the abdomen is of limited value for evaluating right upper quadrant pain. Although abdominal radiographs performed for initial evaluation may identify gallstones, they are not sufficient for establishing diagnoses of AC. Ultrasound (US) and cholescintigraphy are the imaging studies most often used to diagnose AC. Computed tomography (CT), however, may confirm or refute the diagnosis and reveal complications that are less clearly identified using other imaging modalities. Several studies support the diagnostic potential for magnetic resonance imaging (MRI) in patients with suspected AC; however, its use has yet to be fully assessed.

### Ultrasound and Cholescintigraphy

An initial study from 1981 defined the sonographic Murphy sign as focal tenderness corresponding to a sonographically localized gallbladder, which, along with stones, sludge, and gallbladder wall thickening, allowed for separating AC from gallstones alone and chronic cholecystitis with gallstones. Unfortunately, the sonographic Murphy sign has a relatively low specificity for AC, and its absence is unreliable as a negative predictor of AC if the patient has received pain medication prior to imaging. Since that initial study, many subsequent studies have been conducted to assess the accuracy of US and cholescintigraphy. One meta-analysis reviewed 22 studies evaluating cholescintigraphy and 5 studies evaluating US published between 1978 and 1990. The authors concluded that cholescintigraphy demonstrated the best sensitivity (97%; 95% confidence interval [CI]: 96%, 98%) and specificity (90%; 95% CI: 86%, 95%) in detecting AC, whereas US had a sensitivity of 88% (95% CI: 74%, 100%) and specificity of 80% (95% CI: 62%, 98%).

A 2012 meta-analysis built on the results of the earlier meta-analysis and included 40 studies evaluating cholescintigraphy and 26 studies evaluating US published between 1978 and 2010. This analysis confirmed the sensitivity and specificity values noted by the earlier meta-analysis, with cholescintigraphy at 96% (95% CI: 94%, 97%) and 90% (95% CI: 86%, 93%), respectively. However, the 2012 meta-analysis reported a slightly lower sensitivity for US at 81% (95% CI: 75%, 87%) and slightly higher specificity at 83% (95% CI: 74%, 89%). Similarly, direct comparisons of the diagnostic accuracy of US and cholescintigraphy performed in 11 studies confirmed the superior accuracy of cholescintigraphy.

Although cholescintigraphy is recognized to have a higher sensitivity and specificity, US remains the initial test of choice for imaging patients with suspected AC for a variety of reasons, including greater availability, shorter gallstones, evaluation of intrahepatic and extra-hepatic bile ducts, and identification or exclusion of alternative diagnoses.

Despite providing information limited to the hepatobiliary tract, cholescintigraphy has been advocated as a useful preoperative modality. Specifically, findings of gallbladder nonvisualization or gallbladder ejection fraction <30% are noted to be useful in predicting the severity of cholecystitis and are associated with a higher complication rate in the setting of laparoscopic cholecystectomy. Ideally, the surgeon or emergency physician, in consultation with the radiologist, should determine the role of scintigraphy in each case.

### Computed Tomography

Although it has not been advocated as a primary imaging examination for acute right upper quadrant pain, CT can confirm or refute the diagnosis of AC in equivocal cases based on US and/or scintigraphy and reveal such complications as gangrene, gas formation, intraluminal hemorrhage, and perforation. Furthermore, CT has been advocated as a useful modality in preoperative planning, with the absence of gallbladder wall enhancement and/or presence of a stone within the infundibulum associated with conversion from laparoscopic to open cholecystectomy. Prior knowledge of these imaging findings may therefore help guide appropriate surgical approach.

Clinical conditions that can mimic AC, in terms of presentation with acute right upper quadrant pain, include chronic cholecystitis, peptic ulcer, pancreatitis, gastroenteritis, and bowel obstruction, among others. If US and/or scintigraphy are negative for AC and there is no alternative diagnosis, CT, preferably with intravenous contrast, is the next preferred imaging examination for identifying those disorders. When a diagnosis of AC is not prospectively suspected, CT may also be used to demonstrate AC in patients who have nonspecific abdominal pain.

### Magnetic Resonance Imaging

AC can be confirmed or excluded by an abdominal MRI using various protocols, which often include the use of an intravenous gadolinium-based contrast agent. As with CT, MRI is not advocated as a primary imaging examination to evaluate acute right upper quadrant pain; however, several studies have suggested that abdominal MRI is a reliable alternative and can be particularly helpful in the patient who is difficult to examine with US. Although factors such as longer acquisition times limit its use in the emergency setting, less interpreter variability and more consistent visualization of the extra-hepatic biliary tree are important advantages of its use. MRI can be the next best imaging modality when AC is excluded, and it is considered the best modality for evaluating hepatic and biliary abnormalities that are not characterized by US.

Few studies have examined the role of MRI in evaluating AC. Based on the available literature encompassing several small studies, MRI sensitivity estimates range from 50% to 91%, with specificities ranging from 79% to 89%. According to the 2012 meta-analysis, the summary sensitivity is 85% (95% CI: 66%, 95%) and specificity is 81% (95% CI: 69%, 90%), similar to those of US. Additional studies with larger sample sizes are needed to better clarify the role of abdominal MRI in evaluating AC.

### Pregnant Patients

As in the general population, US is the imaging test of choice for evaluating AC in pregnant patients. MRI is the preferred test to follow an inconclusive US, as it can be used to evaluate the entire biliary system and diagnose other causes of acute abdominal pain without exposing the patient to ionizing radiation. Magnetic resonance cholangiopancreatography is helpful in identifying patients who require immediate intervention for pancreatic or biliary pathology. It also helps guard against unnecessary endoscopic retrograde cholangiopancreatography by excluding a biliary abnormality, when US findings are equivocal. Note that during pregnancy, intravenous gadolinium is generally not administered, as it is a class III agent in pregnancy.

### Acalculous Cholecystitis

The diagnosis of acute acalculous cholecystitis (AAC) is more problematic than calculous AC. AAC is a serious and potentially lethal condition that mainly affects critically ill patients who frequently have significant comorbidity. It often presents with clinical, radiologic, and laboratory features that are complex and nonspecific. Diagnosis of acalculous cholecystitis, in both hospitalized patients and emergency room patients, is often one of exclusion.

The use of US and/or scintigraphy has been advocated for AAC. The usefulness of US is limited, however, as gallbladder abnormalities are common with US in critically ill patients, with no apparent correlation to clinical or biochemical parameters related to AAC. Cholescintigraphy may be a more sensitive diagnostic test, because most cases of AAC are associated with cystic duct obstruction, similar to the calculous form of the disease. Some cases of AAC, however, are related to direct inflammation of the gallbladder, leading to false-negative studies when using cholescintigraphy. It should also be noted that diagnostic specificity is limited with cholescintigraphy, as nonvisualization of the gallbladder is a common imaging finding when no inflammation is present, despite preimaging cholecystikinin administration. CT also has a role in evaluating these critically ill patients, although, as with US, the frequent prevalence of nonspecific abnormal imaging findings in the gallbladders of critically ill patients limits its diagnostic value. Nevertheless, when the gallbladder appears completely normal on CT, there is a low probability of any surgical finding in the gallbladder. MRI has not been evaluated sufficiently in AAC and is often impractical, given patient comorbidity.

Laparoscopic cholecystectomy is the definitive treatment for patients with AC, as its operative mortality is as low as 0.8% in patients who have major risk factors. However, significant morbidity and mortality have been reported among patients who have a high surgical risk. Percutaneous cholecystostomy, which can be both diagnostic and therapeutic, is often a safe approach in hospitalized patients suspected of having AAC. Following aspiration of the bile, gallbladder drainage catheter placement may be accomplished immediately, if indicated. This can frequently bridge patients to cholecystectomy at a subsequent time.

## Summary

- When AC is suspected in patients who have right upper quadrant pain, the diagnosis should be confirmed or excluded using US and/or cholescintigraphy.
- US is preferred as the initial imaging test, with supplemental cholescintigraphy used in problematic cases, if the latter could potentially alter patient management.
- CT or MRI may be helpful in equivocal cases and used to identify complications of AC.
- If AC is excluded by US and/or scintigraphy, CT or MRI may be appropriate, depending on the clinical scenario.
- MRI is the preferred test for pregnant patients with right upper quadrant pain when US is inconclusive.
- Percutaneous cholecystostomy may be both diagnostic and therapeutic in patients with acalculous cholecystitis.
- These guidelines should allow the radiologist, emergency physician, and surgeon to be confident when choosing an expedient modality or combination of modalities to establish or exclude this important diagnosis.

## Safety Considerations in Pregnant Patients

Imaging of the pregnant patient can be challenging, particularly with respect to minimizing radiation exposure and risk. For further information and guidance, see the following ACR documents:

- [ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation](#)
- [ACR-ACOG-AIUM Practice Guideline for the Performance of Obstetrical Ultrasound](#)
- [ACR Manual on Contrast Media](#)
- [ACR Guidance Document for Safe MR Practices](#)

## Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e.,  $<30$  mL/min/1.73m<sup>2</sup>), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates  $<30$  mL/min/1.73m<sup>2</sup>. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

## Abbreviations

- CT, computed tomography
- ICU, intensive care unit
- MRI, magnetic resonance imaging
- US, ultrasound
- WBC, white blood cell

## Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
<input type="text"/>	<0.1 mSv	<0.03 mSv
<input type="text"/> <input type="text"/>	0.1-1 mSv	0.03-0.3 mSv

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	10-30 mSv	3-10 mSv
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies".		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Right upper quadrant pain

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Critical Care

Emergency Medicine

Family Practice

Gastroenterology

Internal Medicine

Nuclear Medicine

Radiology

Surgery

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management



## Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with right upper quadrant pain

## Target Population

Patients with right upper quadrant pain

## Interventions and Practices Considered

1. Ultrasound (US) abdomen
2. Computed tomography (CT) abdomen
  - With contrast
  - Without contrast
  - Without and with contrast
3. Cholescintigraphy
4. Magnetic resonance imaging (MRI) abdomen
  - Without and with contrast
  - Without contrast
5. Percutaneous cholecystostomy

## Major Outcomes Considered

Utility of radiologic examinations in differential diagnosis

## Methodology

### Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

Staff will search in PubMed only for peer reviewed medical literature for routine searches. Any article or guideline may be used by the author in the narrative but those materials may have been identified outside of the routine literature search process.

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 10 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

## Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

## Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

## Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

## Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence (study quality) for each article included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

## Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

## Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distribute surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each

procedure. The surveys are completed by panelists without consulting other panelists. The appropriateness rating scale is an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate"; 4, 5, or 6 are in the category "may be appropriate"; and 7, 8, or 9 are in the category "usually appropriate." Each panel member assigns one rating for each procedure for a clinical scenario. The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating.

If consensus is reached, the median rating is assigned as the panel's final recommendation/rating. Consensus is defined as eighty percent (80%) agreement within a rating category. A maximum of three rounds may be conducted to reach consensus. Consensus among the panel members must be achieved to determine the final rating for each procedure.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is proposed as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

This modified Delphi method enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. A more detailed explanation of the complete process can be found in additional methodology documents found on the [ACR Web site](#)  (see also the "Availability of Companion Documents" field).

## Rating Scheme for the Strength of the Recommendations

Not applicable

## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

Internal Peer Review

## Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with right upper quadrant pain

## Potential Harms

Imaging of the pregnant patient can be challenging, particularly with respect to minimizing radiation exposure and risk.

### Gadolinium-based Contrast Agents

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e.,  $<30$  mL/min/1.73 m<sup>2</sup>), and almost never in other patients. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates  $<30$  mL/min/1.73 m<sup>2</sup>. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

### Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

## Qualifying Statements

### Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Getting Better

## IOM Domain

Effectiveness

Patient-centeredness

## Identifying Information and Availability

### Bibliographic Source(s)

Yarmish GM, Smith MP, Rosen MP, Baker ME, Blake MA, Cash BD, Hindman NM, Kamel IR, Kaur H, Nelson RC, Piorkowski RJ, Qayyum A, Tulchinsky M, Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® right upper quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 9 p. [44 references]

### Adaptation

Not applicable: The guideline was not adapted from another source.

### Date Released

1996 (revised 2013)

### Guideline Developer(s)

American College of Radiology - Medical Specialty Society

### Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

### Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Gastrointestinal Imaging

### Composition of Group That Authored the Guideline

*Panel Members:* Gail M. Yarmish, MD (*Principal Author*); Martin P. Smith, MD (*Co-Author*); Max P. Rosen, MD, MPH (*Panel Chair*); Mark E. Baker, MD (*Panel Vice-chair*); Michael A. Blake, MB, BCh; Brooks D. Cash, MD; Nicole M. Hindman, MD; Ihab R. Kamel, MD, PhD; Harmeet Kaur, MD; Rendon C. Nelson, MD; Robert J. Piorkowski, MD; Aliya Qayyum, MD; Mark Tulchinsky, MD

### Financial Disclosures/Conflicts of Interest

Not stated

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Katz DS, Rosen MP, Blake MA, Baker ME, Cash BD, Fidler JL, Grant TH, Greene FL, Lalani T, Miller FH, Small WC, Sudakoff GS, Warshauer DM, Yee J, Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® right upper quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2010. 5 p.

## Guideline Availability

Electronic copies: Available from the [American College of Radiology \(ACR\) Web site](#) .

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

## Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#) .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2013 Nov. 2 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 90 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria® right upper quadrant pain. Evidence table. Reston (VA): American College of Radiology; 2013. 16 p. Electronic copies: Available in PDF from the [ACR Web site](#) .

## Patient Resources

None available

## NGC Status

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